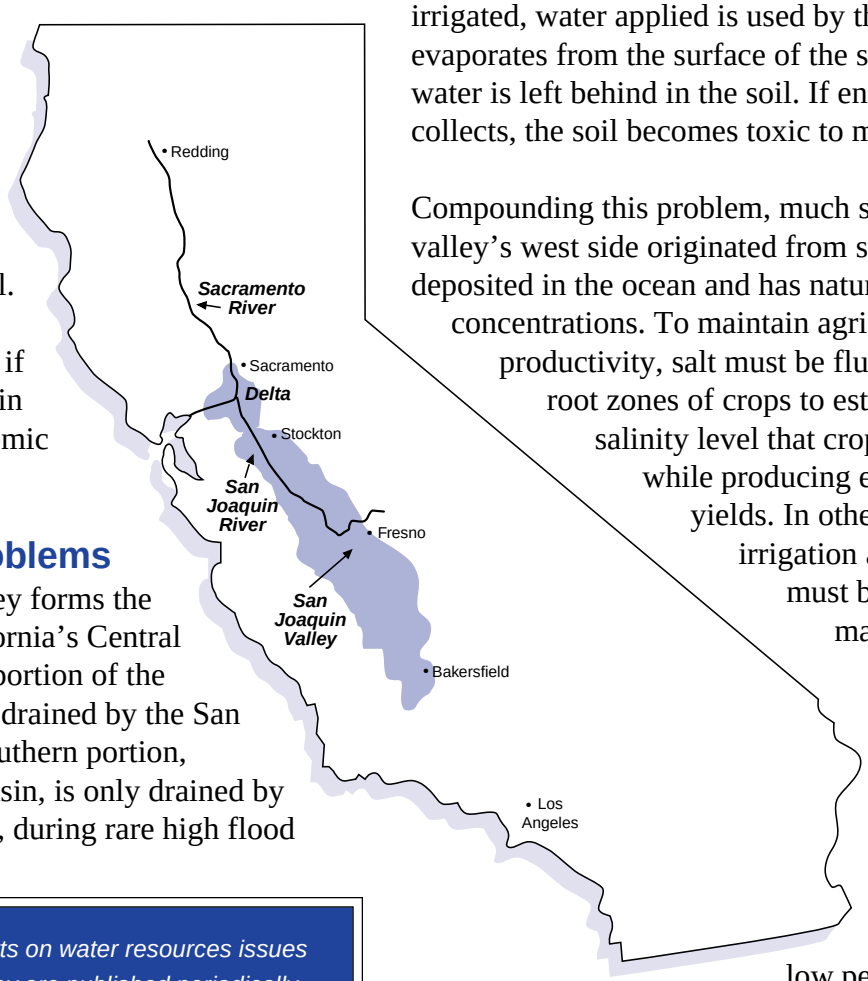
water facts

No. 20

Salt Balance in the San Joaquin Valley

California's San Joaquin Valley is one of the world's most vital and productive farming areas. But continued salt buildup in valley water and soils has reduced this productivity and threatens agricultural sustainability.

This salt problem is widespread and complicated. Most solutions are neither simple nor economical. Yet real and lasting solutions are essential if the valley is to maintain agricultural and economic productivity.



Salt Buildup Problems

The San Joaquin Valley forms the southern half of California's Central Valley. The northern portion of the San Joaquin Valley is drained by the San Joaquin River. The southern portion, essentially a closed basin, is only drained by the San Joaquin River, during rare high flood events.

All water flowing into the valley, or pumped from the ground contains salt, derived from the natural weathering of the Earth's crust. Most of this water is used for irrigation. When valley crops are irrigated, water applied is used by the crops or evaporates from the surface of the soil. Salt in the water is left behind in the soil. If enough salt collects, the soil becomes toxic to most crops.

Compounding this problem, much soil on the valley's west side originated from sediments deposited in the ocean and has naturally high salt concentrations. To maintain agricultural productivity, salt must be flushed from the root zones of crops to establish a soil salinity level that crops can tolerate while producing economic yields. In other words, irrigation applications must be managed to maintain a healthy salt balance.

Geologic conditions make this task difficult. A shallow and low permeability layer of clay underlies thousands of acres of farmland on the valley's west side. Applied water meant to flush salt from crop root zones collects on top of the clay, and groundwater levels rise with each irrigation. In some areas, this salty

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groundwater saturates crop root zones and reduces productivity.

Shallow, salty groundwater underlies nearly 700,000 acres of irrigated valley farmland. Ultimately, more than 1 million acres may be similarly affected. Historically, farmers have maintained productivity on this land by:

- Installing underground drainage systems to collect shallow groundwater.
- Forming improvement districts to fund and build facilities that collect drainage water from farms and convey it elsewhere.

Unfortunately, such systems and facilities only solve the simple part of the problem: collection. The hard part—how to dispose of the salty water without posing a threat to the environment—remains a daunting challenge.

In an average year, surface water supplies carry more than 800,000 tons of salt into the San Joaquin Valley's northern portion—and another 2 million tons into its southern portion. Only 350,000 tons of salt leave the northern valley each year, all by the San Joaquin River. Virtually no salt leaves the southern valley. The added volume of salt entering the valley each year is enough to fill 8 football fields—each 100 feet high.

Achieving a salt balance would require removing another 2.45 million tons of salt a year, in addition to the quantity that flows out from the San Joaquin River. Put a different way, in addition to current exports, 11 semitrailers, each loaded with 25 tons of salt, would have to depart each hour, every day throughout the year, to strike this balance.

Current Salt Management Activities

Today, individual growers and government agencies are working together to maintain existing levels of agricultural activity in the valley.

At the farm level, growers are reducing water use by irrigating more efficiently, a practice that

Major Sources of Imported Salt

Most of the salt entering the San Joaquin Valley comes from water imported from the Sacramento-San Joaquin Delta. The rest comes from local precipitation and runoff onto the valley floor. Most water imported from the Delta is delivered to land on the valley's west side, where drainage problems are common and natural salt concentrations are typically high.

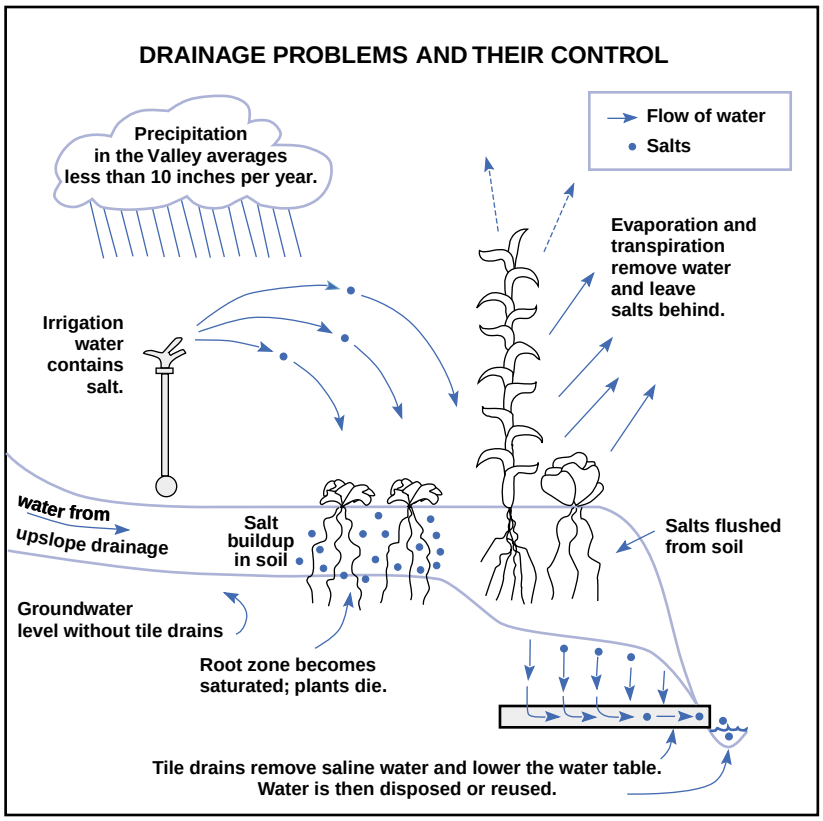
Fertilizers, pesticides, and soil amendments add thousands of tons of salt to valley land and water each year. Some of these chemicals remain in the valley; others leave as gasses or get absorbed by plants that are harvested and shipped to market. A sizable amount also ends up in drainage water. These chemicals contribute significantly to the valley's salt balance problem, but data on their volume and range are limited.

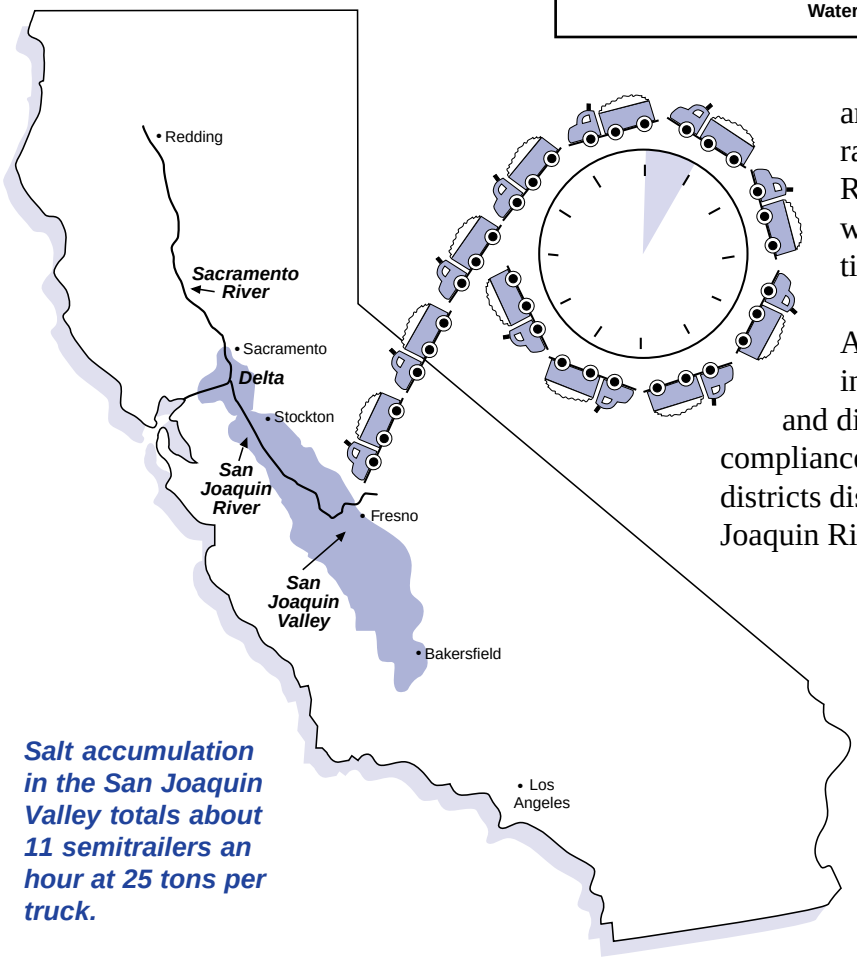
What is Salt?

Salt includes any ionized form of a mineral element or compound that readily dissolves in water. Total dissolved solids is a measure of salt content.

decreases the volume of water and salt imported into the valley. Additionally, some growers have switched to crops that can be irrigated with a blend of fresh water and salty drainage water, a practice that decreases the volume of water and salt imported, but does not reduce salt buildup in soils.

One grower has established an experimental reuse of drainage water. In this demonstration project, saline drainage water is sequentially reused to irrigate crops of progressively increasing salt tolerance and salt is separated from the residual brine by evaporation in a solar evaporator, an area where drainage water is sprayed at a rate equivalent to daily evaporation. Reuse systems productively use drainage water and consequently conserve irrigation water.





Salt accumulation in the San Joaquin Valley totals about 11 semitrailers an hour at 25 tons per truck.

At the district level, growers are collecting drainage water from the farm drains and discharging to evaporation ponds in compliance with regulatory requirements. Some districts discharge drainage water to the San Joaquin River on a schedule that does not compromise current water quality standards. Current water quality in the river has been determined to be impaired, therefore, future water quality standards upstream of Vernalis are expect to be more restrictive, allowing less drainage discharge to the river.

Future Salt Management Activities

Measures already implemented are helping to maintain the agricultural productivity of valley farmland, but a long-term solution has not been achieved. A coalition of government agencies, local districts, growers, the University of California and other stakeholders is forming to address the need to achieve sustainability. Current options in an existing drainage management plan include:

- Further development of sequential drainage reuse systems;
- Further development of biological and filtration drainage treatment systems to remove salt and selenium;
- Retirement of the most salt-impacted irrigated lands;
- Continued operation of evaporation ponds;
- Further expansion of water use efficiency;
- Comprehensive groundwater management;
- Research on separation and utilization of salts from soils and groundwater or planning for in-valley disposal of salts.

For More Information

For more details about salt balance problems and possible solutions in the San Joaquin Valley, contact the following people at these DWR offices.

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wwwdpla.water.ca.gov/agriculture/drainage/implementation/hq/title.htm

Department of Water Resources Web site:
www.water.ca.gov